

EXHIBIT B

**UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF PUERTO RICO**

In re:

THE FINANCIAL OVERSIGHT AND
MANAGEMENT BOARD FOR PUERTO RICO,

as representative of

THE COMMONWEALTH OF PUERTO RICO, *et al.*,
Debtors.¹

PROMESA

Title III

No. 17-BK-3283-LTS

(Jointly Administered)

In re:

THE FINANCIAL OVERSIGHT AND
MANAGEMENT BOARD FOR PUERTO RICO,

as representative of

PUERTO RICO ELECTRIC POWER AUTHORITY,
Debtor.

PROMESA

Title III

No. 17-BK-4780-LTS

(Jointly Administered)

EXPERT REBUTTAL REPORT OF ANDREW WOLFE

1. I submit this report in response to the Expert Report of Prof. Sebastian Edwards dated April 28, 2023 which expresses opinions on certain methodologies and macroeconomic

¹ The Debtors in these Title III Cases, along with each Debtor's respective Title III case number and the last four (4) digits of each Debtor's federal tax identification number, as applicable, are the (i) Commonwealth of Puerto Rico (Bankruptcy Case No. 17-BK-3283-LTS) (Last Four Digits of Federal Tax ID: 3481); (ii) Puerto Rico Sales Tax Financing Corporation ("COFINA") (Bankruptcy Case No. 17-BK-3284-LTS) (Last Four Digits of Federal Tax ID: 8474); (iii) Puerto Rico Highways and Transportation Authority ("HTA") (Bankruptcy Case No. 17-BK-3567-LTS) (Last Four Digits of Federal Tax ID: 3808); (iv) Employees Retirement System of the Government of the Commonwealth of Puerto Rico ("ERS") (Bankruptcy Case No. 17-BK-3566-LTS) (Last Four Digits of Federal Tax ID: 9686); (v) Puerto Rico Electric Power Authority ("PREPA") (Bankruptcy Case No. 17- BK-4780-LTS) (Last Four Digits of Federal Tax ID: 3747); and (vi) Puerto Rico Public Buildings Authority ("PBA") (Bankruptcy Case No. 19- BK-5523-LTS) (Last Four Digits of Federal Tax ID: 3801) (Title III case numbers are listed as Bankruptcy Case numbers due to software limitations).

assumptions and inputs that underlie the electricity load projection used in PREPA's Plan of Adjustment, and the Expert Reports of Dr. Susan Tierney and Dr. Maureen Chakraborty, both dated April 28, 2023, to the extent Dr. Tierney's and Dr. Chakraborty's reports utilize economic assumptions.

I. Qualifications

2. I have served as an economic advisor to the Financial Oversight and Management Board for Puerto Rico (the "Oversight Board") and to the Government Development Bank for Puerto Rico, a Fiscal Consultant for the Inter-American Development Bank, and as an Adjunct Professorial Lecturer at both the School of International Service at American University in Washington, D.C. and the Baker Institute for Public Policy at Rice University in Houston, Texas.

3. Prior to the foregoing roles, I worked at the International Monetary Fund ("IMF") for 27 years. When I left the IMF in 2014, I was the Head of the IMF Human Resource Strategy Unit, and, immediately before that, I was the Senior Personnel and Budget Manager of the Western Hemisphere Department. During my years at the IMF, I was IMF Mission Chief to El Salvador, Colombia, the Dominican Republic, Uruguay and Peru and IMF Resident Representative in Uruguay, Argentina and Peru. My responsibilities in those positions included leading negotiations on IMF-supported programs, monitoring fiscal deficits in those countries as well as examining whether IMF financial and economic projections were met. While at the IMF, I set policy reform agendas for lending programs in coordination with senior advisors at the IMF and senior financial officials for the governments in question. I also oversaw the IMF teams that monitored performance of those countries pursuant to such lending programs and whether those countries adhered to agreed-upon structural reforms and fiscal and monetary programs.

4. I received my Ph.D. in Economics from the University of Wisconsin in 1985, and my B.S.E. in Economics and B.A.S. in Engineering from the University of Pennsylvania in 1978.

5. A full resume is attached as Exhibit A. A list of my testimony in other cases is attached as Exhibit B.

6. I am paid \$850 per hour for my time.

II. Documents and Data Sources

7. The documents and data on which I relied in forming the opinions expressed in this report are (i) those identified in Prof. Edwards', Dr. Chakraborty's and Dr. Tierney's reports; and (ii) those cited in this report, including the documents and data identified in Exhibit C.

III. Summary

8. I was asked to opine on the Expert Report of Prof. Sebastian Edwards dated April 28, 2023, as well as the Expert Reports of Dr. Susan Tierney and Dr. Maureen Chakraborty, both dated April 28, 2023, to the extent those latter reports utilize macroeconomic assumptions. This rebuttal report has two principal sections: a response to Prof. Edwards' report and a response to Drs. Tierney's and Chakraborty's reports.

9. Prof. Edwards contends the accepted methodology for projecting economic growth is to estimate the "Potential Output" by relying upon the Solow Growth Model. However, contrary to Prof. Edwards' critique, the Oversight Board was correct to use its linear regression methodology to project the growth of Puerto Rico's gross national product ("GNP"). The linear regression was carried out on a growth model using a vector autoregression ("VAR") methodology and a seemingly unrelated regression ("SUR") analysis to understand the interactions of labor and output growth in Puerto Rico in the wake of Hurricane Maria. VARs

are a standard methodological tool for forecasting purposes and, unlike Solow growth models (“SGM”), are useful for short- and medium-term forecasting.

10. The results of the SUR underscored that labor in Puerto Rico is not exogenous in determining output growth, but rather labor supply decisions are impacted by growth. In the context of a shrinking economy that means labor will migrate off the Island. In the VAR, labor as an input to production is captured in the lagged factor of the previous period’s GNP growth. The Oversight Board’s regression model was therefore appropriate and an SGM, which takes labor as an independent variable, would have been inappropriate to project Puerto Rico’s GNP.

11. Because Puerto Rico’s labor force is highly mobile—and can and does out-migrate in the event of a downturn—Prof. Edwards’ comparison of Puerto Rico to sovereign nations is inappropriate. Residents of Puerto Rico are citizens of the United States and can and do relocate to the mainland United States, with a higher number of Puerto Ricans living stateside than on the island.² The comparison is also inappropriate because, unlike a nation, Puerto Rico does not have access to international sources of financing to help it recover in the event of a prolonged period of economic decline that typically would require structural reform.

12. Prof. Edwards also argues that the Board’s economic projections are too pessimistic. Even if an SGM were appropriate in this circumstance—which it is not—the parameters and assumptions of Prof. Edwards’ SGM are far too optimistic. Setting these to realistic values yields GNP growth projections, even utilizing an SGM, that are very similar to those projected by the Oversight Board’s regression model.

² Bureau, United States Census. *HISPANIC OR LATINO ORIGIN BY SPECIFIC ORIGIN - United States - 2019 American Community Survey 1-Year Estimates*, 1 July 2019, <http://www.data.census.gov/table?q=B03001%3A%2BHISPANIC%2BOR%2BLATINO%2BORIGIN%2BBY%2BSPECIFIC%2BORIGIN&tid=ACSDT1Y2019.B03001>.

13. Prof. Edwards misstates the effect of a reduction in the value of PREPA bondholders' debt. The Oversight Board's proposed reduction is appropriate and in any event does not threaten unexpected social and market costs.

14. The reports of Dr. Chakraborty and Dr. Tierney contain several flaws, including a misplaced reliance on income attributable to the informal economy, an overly optimistic view of the affordability and effects of marginal additional electricity charges, and an overly skeptical view of the attractiveness of solar power for household electricity generation.

IV. Response to Prof. Edwards' Report

A. The Oversight Board's regression appropriately projected GNP.

15. The Oversight Board built a regression model to project Puerto Rico's future GNP growth. That model, the current version of which Prof. Edwards has reviewed, was built following Hurricane Maria. At that time, a vector autoregression (VAR) model was adapted as there was no known relationship between concurrent and lagged effects of labor movements on output, nor output changes on labor movements. When faced with a set of factors where most variables are considered exogenous, but two or more variables are thought to affect each other, with no known relationship between concurrent and lagged effects, an appropriate tool is a VAR. This is because a VAR tests the relationship between two or more variables that may affect each other, including the lagged effects of the variables on each other (*i.e.*, how one variable in time $t - n$ might affect another variable at time t). The Oversight Board's VAR in effect tested whether population flows (and hence labor inputs) were endogenous or exogenous, *i.e.*, whether the outflow of labor drives down real GNP growth or, instead, real GNP growth outcomes (or lack

thereof) drive labor mobility decisions.³ In a regional economy within national borders this is a salient consideration.

16. The seemingly unrelated regression (SUR) results, reflected in the current Commonwealth fiscal plan, do not show labor as an independent variable because, having tested (i) whether GNP growth caused population (hence labor) movements and (ii) whether population movements caused changes in GNP growth, the Oversight Board found that the latter was not statistically significant. At first this might seem counterintuitive, but it actually makes sense. It makes sense because the structure of the model is saying that people do not leave the Island for factors outside the model and then GNP falls. Rather, the opposite is true: GNP falls and then people leave the Island. In other words, Puerto Rico migration is not exogenous. People do not simply decide to leave and then GNP growth is affected. Rather, GNP growth conditions are poor and that leads to decisions to leave the Island. Indeed, although the Oversight Board's model shows a steadily shrinking economy, a far more troubling scenario is possible: declining GNP could reach a tipping point that would cause a mass exodus off the Island, causing severe economic collapse, which in turn would cause a vicious downward spiral and complete collapse.

17. The result of this analysis is the Oversight Board's Commonwealth growth forecast model, which is the basis for PREPA's GNP growth projection.

18. The regression is superior to the SGM that Prof. Edwards advocates because the regression is useful as both a longer-term trend-analysis tool, and also for shorter- and medium-term trend forecasting (*i.e.*, over the next five years), something to which an SGM, which is intended for long-term projections only, is unsuited. In addition, the regression, unlike Prof.

³ While VAR models are not the only valid technique for growth forecasting, they are widely used. See for example, Robertson and Tallman (1999); Sims (1992) and (1998), and Keating (1992).

Edwards' SGM, has the advantage of being explicitly linked to mainland U.S. growth—a very strong predictor of Puerto Rico GNP.⁴

19. To the regression's baseline modeling of GNP are added three principal growth factors—(i) the expansionary impact of Federal Emergency Management Agency (“FEMA”) spending and COVID relief programs; (ii) the contractionary impact of fiscal consolidation; and (iii) the permanent increase in growth owing to structural reform of the economy. These are all appropriately estimated in the growth forecast of the Oversight Board.

20. In this connection, Prof. Edwards overstates the impact of the structural reform agenda in the 2022 Commonwealth Fiscal Plan. The 2022 Commonwealth Fiscal Plan contains only relatively modest efforts to reform the Puerto Rico economy. Most notably, in the labor market, the Fiscal Plan's sole reform is the introduction of an earned-income tax credit; the Fiscal Plan includes no measures to increase the demand for labor. Overall, the 2022 Commonwealth Fiscal Plan's proposed changes, individually or collectively, will only have limited transformative potential. Thus, when the effects of stimulus spending wear off, the economy will return to the negative trend forecasted in the Oversight Board's baseline projection, contrary to Prof. Edwards' suggestion that recent economic trends indicate upward growth (which on a permanent basis they do not).

21. Other aspects of the regression that Prof. Edwards questions are likewise appropriate:

⁴ A study by Brown (2017) finds that “[o]n average, the non-energy-producing states were synchronized with the United States 77 percent of the time.” In my work with Dr. Anne Krueger on the “Krueger Report,” we found historically there had been a strong co-movement of economic activity between Puerto Rico and the mainland (Krueger (2015) Report, p. 5).

- a. The model's time-interaction with previous year's GNP—the “structural break” variable—accounts for the phasing out of the Tax Code's Section 936 incentives starting in 1996 and full elimination in 2006.
- b. The PREPA Plan of Adjustment uses the non-income-adjusted GNP growth series because this series appropriately projects the demand for electricity from industrial and commercial producers whose activity was curtailed during COVID.
- c. The data used in the regression model is sufficiently accurate and the best available. Alternative data used by Prof. Edwards in his SGM (*e.g.*, from the World Bank) is not appropriate as it contains estimates of the highly uncertain parameters of the informal sector in Puerto Rico.
- d. In the regression model, all the inputs to production (*e.g.*, capital) and other factors considered (*e.g.*, mainland GDP growth) are consistent with the model's growth forecast.

B. The Oversight Board's projected decline is not unusual and is consistent with Puerto Rico's status as a regional economy with fluid labor.

22. Prof. Edwards is wrong to claim that the secular contraction in economic activity forecast by the Oversight Board's regression model is counter to experience and would set Puerto Rico apart from the rest of the world. Puerto Rico is a region within the United States and not a sovereign nation. As such, comparing Puerto Rico to other nations, as does Prof. Edwards, is inappropriate, especially when regional data exists.

23. Unlike labor confined within national borders, labor in Puerto Rico is free to move to another region where economic prospects are better. Even in the European Union, where borders are technically open, labor mobility is hampered by cultural factors and nationality change. Not so in Puerto Rico. Among other things, there are many mainland Puerto

Rican communities that can and do make migration smoother and more attractive than cross-border migration within Europe.

24. This is in contrast to, say, a Greek national out-migrating following the 2009 financial crisis. While legally free to move to another European country, the cultural and community-loss costs for a Greek emigree evidently prevented high levels of migration, as the table below shows:

Labor Mobility Comparison: Greece Under Crisis and Puerto Rico Under Long-term Economic Decline

Greece	GDP real growth	Population	% change	Puerto Rico	GDP real growth	Population	% change
2009		11,107,017		FY11		3,691,261	
2010	-3.5%	11,121,341	0.1%	FY12	0.54%	3,679,154	-0.3%
2011	-9.1%	11,104,899	-0.1%	FY13	-0.13%	3,669,197	-0.3%
2012	-7.3%	11,045,011	-0.5%	FY14	-1.76%	3,626,289	-1.2%
2013	-3.2%	10,965,211	-0.7%	FY15	-0.81%	3,561,312	-1.8%
Cumulative change	-23.1%		-1.3%		-2.2%		-3.5%

Source: data for Greece's GDP is: <https://www.imf.org/en/Countries/GRC#countrydata>.

Source: For Puerto Rico the FY23 fiscal plan of the Commonwealth and the Statistical Appendix for growth.

Source: data for Greek population is: <https://data.worldbank.org/indicator/SP.POP.TOTL?locations=GR>.

25. Regional economies can experience long-term secular declines, particularly where there is outmigration. Counties within West Virginia are an example:

West Virginia Regional Decline							
County	Real GDP 2002	Population 2002	Real GDP 2021	Population 2021		% change GDP	% change pop
South							
Mingo	1,311,181	27,442	452,236	23,005		-65.5%	-16.2%
Wyoming	716,508	23,005	591,307	21,051		-17.5%	-8.5%
Central							
Clay	332,437	10,284	119,183	7,892		-64.1%	-23.3%
Nicholas	769,177	26,120	578,676	26,006		-24.8%	-0.4%
Webster	360,628	9,665	141,270	8,249		-60.8%	-14.7%
East							
Grant	507,719	11,262	400,347	10,983		-21.1%	-2.5%
Pendleton	194,800	7,925	137,151	6,142		-29.6%	-22.5%
Source: FRED. Data available starting in 2002 and last year is 2021.							
Real GDP in 1000's of chained 2012 US dollars.							

26. A long-term projected decline in a region (unlike a nation) also makes sense because a region does not have access to lenders such as the World Bank or the IMF to finance reforms to reverse the long-term downturn.

27. In short, Puerto Rico's projected long-term decline in GNP—combined with (modest) long-term per capita GNP growth and outmigration—is not unexpected or unprecedented for a regional economy with geographically fluid labor.

C. Prof. Edwards' SGM is flawed by overly optimistic assumptions and, if properly parameterized, would lead to a GNP growth projection path similar to that forecasted by the Oversight Board.

28. The SGM is a standard tool for analyzing long-run growth trends. But as discussed above, it is more appropriate for the study of national economies or sovereigns as opposed to regional economies. Furthermore, it is an analysis of potential, and an underlying assumption of the model is that the economy is at full employment—a situation that has rarely existed in Puerto Rico in recent times. Notwithstanding this general critique, I show below that

using historical rates of growth of total factor productivity (TFP)—instead of the unrealistic TFP growth rates that Prof. Edwards utilized (that begin at 0.5% growth and reach 1% per year in 2051)—would result in Prof. Edwards’ SGM generating a growth scenario very similar to the one in the Commonwealth growth model.

29. For Prof. Edwards’ SGM model to produce positive growth over the long run, he has to make overly optimistic assumptions regarding the growth rate of TFP. Specifically, Prof. Edwards assumes that that TFP will start growing at 0.5% in year 1 and this growth rate will rise linearly to 1% by 2051—making for an average (geometric) annual TFP growth rate of 0.82%. Prof. Edwards’ defense of this assumption is based in part on noting that 1% is associated in World Bank studies with a “moderate” growth scenario.⁵ However, Prof. Edwards’ SGM model, while generating positive GNP growth over the long term, is generating an average annual GNP growth rate, from 2027-2051, of only 0.23%. The World Bank would never consider this GNP growth rate to be “moderate.”⁶

30. Moreover, looking at the experience of Japan (a country mired for more than a decade in a low-growth trap), as well as the United States and Germany, two countries with far more dynamic economies than Puerto Rico, reveals a relationship between TFP growth and output growth that is much more contained than assumed by Prof. Edwards for Puerto Rico.

⁵ Specifically, Prof. Edwards states in paragraph 116 of his Report: “The CBO assumes a TFP growth rate of above one percent for the U.S., and the World Bank attributes a one percent TFP growth rate assumption to a ‘moderate’ growth scenario. Other studies have also assumed growth rates in TFP above one percent over long time horizons, and given Puerto Rico’s future plans, a higher TFP growth rate would be warranted.”

⁶ See Excel file Wolfe Master Data.xlsx, tab Edwards v FP TFP correction.

Furthermore, Prof. Edwards' assumed rates of growth of TFP are far in excess of what Puerto Rico experienced between 1996 and 2017.⁷

31. In a cross-country productivity study among the US, Germany and Japan, Baily, Bosworth and Doshi (2020) find that:

Strong economic growth, in turn, comes from two sources, the growth in the workforce and the growth in output per worker (that is, labor productivity). The demographic trend in advanced economies has been towards lower birth rates leading to slower growth in the population and in the labor force, with the population aging as its growth slows. Immigration can supplement the growth of the domestic population, but this can generate social stresses and political problems. In the advanced economies, labor force growth is much slower than in past, particularly in Japan but also in Germany and the United States, with a negative impact on the rate of increase of national incomes. With slower labor force growth, that leaves productivity as the main driver of overall economic growth and, unfortunately, it too has slowed. Figure 1 shows the pattern of trend growth in output per employed person as calculated by the Conference Board for the United States, Japan, Europe, and the World Total. Productivity growth in the United States has been slow since the early 1970s, except for a period in the late 1990s and early 2000s. Japan and Germany had much faster growth in the 1970s, but their growth rates have declined sharply since then.⁸

32. The table below shows the average annual TFP and real GDP growth rates of Germany, the United States and Japan over the 25-year period 1992-2016; and, for comparison, the average annual TFP and real GNP growth rates of Puerto Rico over the 25-year forecast period 2027-2051, as projected by Prof. Edwards:⁹

⁷ See Excel file, Wolfe Master Data.xlsx, tab SGM Study 011819.

⁸ Baily, M.N., Bosworth, B. and Doshi, S. "Productivity comparisons: Lessons from Japan, the United States, and Germany," Brookings Institution, January 2020.

⁹ See Excel file Wolfe Master Data.xlsx, tab, WB Growth and TFP Comp.

	TFP and Real Growth 1/2/3/4/			
Average annual growth				
	Germany	US	Japan	Puerto Rico
GDP growth	1.2%	2.7%	0.9%	0.23%
TFP growth	1.0%	1.4%	0.8%	0.82%
1/ Growth data from the World Bank, except for Puerto Rico, from Edwards.				
2/TFP data from Baily, et.al., except Puerto Rico from Edwards.				
3/Geometric average (1992-2016) for US, Germany and Japan. 2027-2051 for Puerto				
4/ GNP growth for Puerto Rico.				

33. What is clear from this table is that in the three large nation-state economies the rate of TFP growth is either about the same as the country's overall growth rate; or below the country's overall growth rate; in the case of the United States, where real output growth was significantly higher than in the other two countries, TFP growth lagged that rate by almost half.

34. It is unreasonable to project that Puerto Rico could have an average rate of growth of TFP almost 4 times its average GNP growth rate. This projection is especially unreasonable in light of the fact that in an SGM model that I had previously developed, I found an average growth for Puerto Rico in TFP of only 0.19% from 1996-2017, well below the 0.82% average rate assumed by Prof. Edwards.¹⁰

35. I adjusted for the unjustified optimism in Prof. Edwards' model by making Prof. Edwards' model's TFP growth rate comparable to the TFP growth rate observed in the period 1996-2017. Making this adjustment brings Prof. Edwards' model's projection of GNP much

¹⁰ See Excel file Wolfe Master Data.xlsx, tabs Full Edwards v FP proj Summary and Edwards v FP TFP Correction.

closer to that of the Commonwealth fiscal plan.¹¹ Notably, the adjusted model is characterized by a negative growth every year starting in 2031 (except in one year when growth is 0.1%).¹²

Thus, even if an SGM is used, as Prof. Edwards advocates, an SGM produces a GNP growth rate projection path similar to that of the Oversight Board's growth model so long as it is parametrized with reasonable underlying assumptions.

¹¹ I also adjusted Prof. Edwards' SGM by using the Oversight Board's GNP projections for 2022-26, not Prof. Edwards' original SGM's projections for this period. The SGM is not appropriate for near-term projections.

¹² For details see Excel file Wolfe Master Data.xlsx, tab Edwards v FP TFP correction.

Revised Edwards SGM, using Historical TFP Growth Rate							
	Baseline Solow GNP projection (using Oversight Board figures for FY2022-26 and Edwards' growth-rate projections thereafter)	Baseline Solow GNP projection year-over- year growth rate	Edwards' year-over- year TFP growth rate	Revised Solow GNP growth- rate projection (using Oversight Board figures for FY2022-26 and historical 0.19% TFP growth rate thereafter)	Revised Solow GNP projection (using historical 0.19% TFP growth rate)	Original GNP projection (using Oversight Board figures)	Difference between Revised Solow GNP projection and original GNP Projection
2021	5,760,878,829						
2022	5,912,790,676	2.64%	0.50%	2.64%	5,912,790,676	5,912,790,676	0.00%
2023	5,967,676,184	0.93%	0.52%	0.93%	5,967,676,184	5,967,676,184	0.00%
2024	5,927,451,827	-0.67%	0.53%	-0.67%	5,927,451,827	5,927,451,827	0.00%
2025	5,927,833,098	0.01%	0.55%	0.01%	5,927,833,098	5,927,833,098	0.00%
2026	5,946,563,741	0.32%	0.57%	0.32%	5,946,563,741	5,946,563,741	0.00%
2027	6,045,545,781	1.66%	0.59%	1.27%	6,021,993,476	6,004,570,633	0.29%
2028	6,128,916,048	1.38%	0.60%	0.97%	6,080,149,618	6,033,336,186	0.77%
2029	6,182,561,710	0.88%	0.62%	0.44%	6,107,190,436	6,027,947,612	1.30%
2030	6,213,043,213	0.49%	0.64%	0.05%	6,109,952,957	6,008,053,246	1.67%
2031	6,234,250,502	0.34%	0.66%	-0.12%	6,102,395,169	5,997,839,019	1.71%
2032	6,225,534,413	-0.14%	0.67%	-0.62%	6,064,433,241	5,953,869,873	1.82%
2033	6,210,345,929	-0.24%	0.69%	-0.74%	6,019,345,100	5,911,662,684	1.79%
2034	6,192,364,187	-0.29%	0.71%	-0.81%	5,970,811,097	5,863,973,453	1.79%
2035	6,179,319,554	-0.21%	0.72%	-0.74%	5,926,349,239	5,814,983,655	1.88%
2036	6,141,622,096	-0.61%	0.74%	-1.16%	5,857,526,746	5,731,494,272	2.15%
2037	6,120,971,740	-0.34%	0.76%	-0.90%	5,804,532,778	5,672,307,517	2.28%
2038	6,112,543,301	-0.14%	0.78%	-0.72%	5,762,541,703	5,625,242,754	2.38%
2039	6,113,298,772	0.01%	0.79%	-0.59%	5,728,507,959	5,587,315,795	2.46%
2040	6,120,355,040	0.12%	0.81%	-0.50%	5,699,591,663	5,556,545,289	2.51%
2041	6,165,587,620	0.74%	0.83%	0.10%	5,705,382,817	5,557,554,115	2.59%
2042	6,135,805,344	-0.48%	0.84%	-1.14%	5,640,471,146	5,501,183,077	2.47%
2043	6,146,455,461	0.17%	0.86%	-0.50%	5,612,361,598	5,477,108,324	2.41%
2044	6,156,063,470	0.16%	0.88%	-0.53%	5,582,456,052	5,454,676,489	2.29%
2045	6,164,507,313	0.14%	0.90%	-0.57%	5,550,678,056	5,433,729,428	2.11%
2046	6,174,416,255	0.16%	0.91%	-0.56%	5,519,432,724	5,414,703,337	1.90%
2047	6,195,068,007	0.33%	0.93%	-0.41%	5,497,000,622	5,402,407,844	1.72%
2048	6,213,425,025	0.30%	0.95%	-0.46%	5,471,614,477	5,386,704,991	1.55%
2049	6,235,663,219	0.36%	0.97%	-0.42%	5,448,772,097	5,372,304,326	1.40%
2050	6,260,499,042	0.40%	0.98%	-0.39%	5,427,285,915	5,360,776,403	1.23%
2051	6,281,745,397	0.34%	1.00%	-0.47%	5,401,751,223	5,350,534,622	0.95%
Simple average 2027-2051		0.22%	0.79%				
Geometric average 2027-2051		0.23%	0.83%				

D. Prof. Edwards' SGM has additional flaws and errors.

36. In addition to its overestimation of TFP, Prof. Edwards' model suffers from other problems:

- a) Prof. Edwards states that the investment rate for non-disaster-relief ("DRF") capital starts at 27.3% in FY2021 (and then declines, etc.). (Edwards Report Ex. 18, parameter 3.) In fact, the material Prof. Edwards relies on for the 27.3% figure

clearly applies to all capital, not just non-DRF capital. Thus, Prof. Edwards' analysis double counts the amount of the capital stock in the Puerto Rican economy going forward; this would inflate his model's GNP numbers over time. Moreover, the post-FY2026 parameter of 23% non-DRF investment trend that Prof. Edwards assumes is somewhat elevated; the average investment rate in the years 2012-2017 is 21.8%.

b) Prof. Edwards calculates the labor share of income in Puerto Rico to be 78.8%.

(Report Ex. 18, parameter 11.) It is not clear from the materials Prof. Edwards has provided how he calculates this figure from the source he identifies (Statistical Appendix 2021).¹³ The figure for the labor share of income provided in at least one source cited by Prof. Edwards is considerably lower than 78.8%.¹⁴

c) Prof. Edwards' model seems to project that the amount of capital per worker (K/L) will continually increase through FY2051. Under standard theory, this ratio ought to stabilize at an equilibrium level as the economy reaches its potential. Although Prof. Edwards has not provided the actual series of capital and labor (*i.e.*, the year-by-year time series that shows annual capital and labor figures), I have endeavored to construct the data set based on the descriptions provided in Prof. Edwards' Report (particularly Exhibit 18).¹⁵ My estimate of Prof. Edwards' numbers shows that the K/L ratio continues to rise every year from 2027 to 2051 by an average of 0.7% per

¹³ According to Prof. Edwards' provided coding notes, he calculates the labor share of income as: $\text{Employees_Compensation_2021} / (\text{Nominal_GNP_2021} - \text{Statistical_Discrepancy_2021} - \text{Indirect_Business_Tax_2021} - \text{Proprietors_Income_2021})$. This formula does not give the 78.8% figure.

¹⁴ Acemoglu (2009), at p. 97, uses a labor share of income of 2/3 (67%).

¹⁵ Information provided includes codes and sources but not the exact data for labor and capital.

year and a cumulative growth of almost 20%.¹⁶ In other words, year after year each worker has more capital to work with—which would mean an ever declining marginal productivity of capital that at some point should slow investment, although investment never slows in Prof. Edwards’ SGM.

E. Prof. Edwards misstates the effects of a reduction of PREPA’s debt.

37. Prof. Edwards speaks to the effects of an “unjustifiably large” haircut on PREPA’s debt. That discussion is therefore irrelevant to the extent the amount of the contemplated “haircut” is appropriate and reasonable (which it is).

38. Moreover, Prof. Edwards’ comparison of PREPA’s Title III case to debt restructurings of sovereign nations is inapt.

39. Even a sovereign that is restructuring debt might have the option of securing financing through official lenders (*e.g.*, the IMF), if the sovereign is willing to take certain actions typically made a condition of such loans. For a sub-sovereign entity (such as a municipality) the options are different.

40. For a municipality, if funding is urgently needed during the period when the entity cannot access capital markets, the state can step in to guarantee the new loans or even directly borrow on behalf of the municipality.

¹⁶ See my estimates of the labor force series in the Edwards model and in the Commonwealth FP 2022 model in the Excel file, Wolfe Master Data.xlsx, tab Labor Force growth comp, and my estimates of the capital stock in the same file, tab K accum & TFP growth Edwards. These results are then used to calculate K/L ratios in the same excel file in the Full Edwards v FP proj summary, columns Q-V.

41. Detroit is a prime example of a positive outcome from municipal bankruptcy proceedings.¹⁷ In July 2013 Detroit filed its bankruptcy petition and around a year later it had reduced its debt by \$7 billion or about 40% of the city's pre-bankruptcy debt. By the end of 2018, Detroit was back borrowing in the municipal bond market. In the interim, it used the savings from the restructuring its obligations to, in part, spend on economic development. While there were costs to many involved in the bankruptcy, one would be hard-pressed to find critics of Detroit's evolution since 2014.

42. No macroeconomic forecast is perfect. But the social and market costs of precipitating another PREPA bankruptcy as a result of overestimating future growth (as Prof. Edwards' projection certainly does) are far greater than the hypothetical costs of underestimating growth, which in any event will be to some degree mitigated by contingent value instruments (CVIs).

V. Response to Drs. Tierney and Chakraborty's Reports.

43. In this section I offer responses to the expert reports of Drs. Tierney and Chakraborty, to the extent those reports touch on macroeconomic concepts. As an initial matter, I note that the 2023 Commonwealth Fiscal Plan is in some respects different than the previous year's Fiscal Plan. This makes sense and is to be expected. Each year the fiscal plan is changed to incorporate the latest information on Puerto Rico's economy. The new fiscal plan also reflects any revisions to fiscal policy stances made by Puerto Rico or the federal government; updates the structural reform agenda of the Puerto Rican government (both in terms of scope of the reforms and the timing of their implementation); and incorporates the latest projection of external

¹⁷ For a full discussion of the Detroit bankruptcy case, see Tatum III, J.L. "Detroit's Bankruptcy and Market Reentry", Emory Bankruptcy Developments Journal, Vol. 37, Issue 1, 2020.

economic factors that affect Puerto Rico (including the CBO's forecast of real growth and inflation in the overall US economy, the outlook for world oil and food prices, and the amount of disaster relief funding, which in the 2023 fiscal plan is a cumulative \$3 billion less than was forecast in 2022). Over time since the first fiscal plan for the Commonwealth was approved by the Oversight Board in early 2017, there have been many changes; for example, the successive plans have had a weakening structural reform agenda that has reduced the projected permanent impact on growth by more than half and, because of Hurricanes Irma, María, and Fiona, the earthquakes in 2019 and 2020, and COVID-19, there has been an ever-changing projection on federal assistance.

44. **Per capita income.** It merits further clarification that, contrary to Dr. Chakraborty's contention that the Oversight Board projects declining median income, the Oversight Board in fact implicitly projects a change in nominal household income that is modestly **positive**. This is evident from the Commonwealth fiscal plan's projected population and GNP figures, the ratio of which increases over time.¹⁸ Although the Oversight Board projects that Puerto Rico's overall real output will fall, that decline will be distributed among a declining number of workers (because the Island's working population is forecast to shrink). The Oversight Board projects that both real and nominal income per capita will rise starting FY25 through to FY51. (This pattern of rising income per capita is consistent with one of the basic tenets of migration theory, namely that labor flows over the long run will tend to even out per capita incomes across regions.)

45. **The informal sector.** In this connection, Dr. Chakraborty attempts to show that households have more income than reported, if one takes into account income from the informal

¹⁸ See the FY2022 Commonwealth Fiscal Plan Excel file, macroforecast tab, lines 35-36.

sector. The informal sector pays minimal levels of taxes, and therefore is not included in the Commonwealth Fiscal Plan model. To add the informal sector into the resource envelope of households in an additive manner is dangerous. Estimates of the size of the informal sector overall are tenuous and quite variable. These estimates are too uncertain to base decisions on how much debt is repayable. Moreover, it is not necessarily the case that inclusion of the informal sector would raise the calculated median household income; in fact, it is more likely that inclusion of the informal sector would lower the calculated median household income, as informal workers presumably earn less than formal workers, and it is likely not the case that most households have both formal and informal incomes.¹⁹ In any event, in my years at the IMF, we never included estimates of informal income in assessing economic program viability because data on the size of the informal economy is unreliable.²⁰ Furthermore, to the extent income data is based on the American Community Survey, which asks respondents to report total income from all jobs, that data already includes income from the informal economy.²¹ Thus making additional adjustments to reported income to account for informal wages could double-count income from informal employment.

¹⁹ The few examples from published literature that describe the structure of informal-sector households suggest that these do not tend to be mixed formal/informal households. *See* Estudios Economicos (2010), p. 15, where the authors note a 1988 study that found that the probability of participating in the informal labor sector is greater among young men, persons with little education, and those living in rural areas.

²⁰ Also, see for example World Bank, Poverty Data: Latin America and Caribbean, 2020 https://databank.worldbank.org/data/download/poverty/33EF03BB-9722-4AE2-ABC7-AA2972D68AFE/Global_POVEQ_LAC.pdf (World Bank estimates of poverty levels in Latin American and Caribbean countries make no adjustments for potential income from the informal economy).

¹⁷ US Census Bureau, American Community Survey, Question 43: <https://www2.census.gov/programs-surveys/acs/methodology/questionnaires/2020/quest20.pdf>.

46. **Share of wallet.** Dr. Chakraborty critiques the 6% share-of-wallet (“SOW”).

However, 6% SOW is substantial, and, as shown in Exhibit 8 in the FY2022 PREPA Fiscal Plan, such a level of SOW in Puerto Rico would increase the SOW gap between Puerto Rico and all electricity consumers in the US.

47. **Feasibility of raising rates.** Dr. Chakraborty calls for raising rates to higher income earners and to industrial and commercial consumers. This would be unwise and inappropriate.

- For the residential consumer: already facing a SOW that is roughly double of what it is on the mainland, higher rates would be another reason to leave the Island, especially given Puerto Rico’s dim prospects of growth for the next 30 years.
- For the commercial and industrial consumer: already at a huge disadvantage on the cost structure of inputs because of minimum wage requirements that are on the order of 250% higher in Puerto Rico than in Jamaica and a minimum 200% higher than in the Dominican Republic, Puerto Rico’s main Caribbean competitors for tourism, additional costs to electricity consumption could have serious consequences, especially on low-profit margin businesses.²²

48. **Solar panels attractive.** Dr. Tierney seems to have a one-sided view of the economic decision by households whether to purchase solar panels. Dr. Tierney suggests that because incomes are low in Puerto Rico, demand for solar panels will be depressed. But it is also the case that the demand for solar panels depends on the expected savings from using less

²² For minimum wages in Jamaica see: <https://www.jamaicaobserver.com/latest-news/national-minimum-wage-up-44-to-13000-weekly-holness/>. For the Dominican Republic see <https://www.sys.do/en/blog/minimum-wage-2021>.

energy from the grid. With costs and SOW at least double that of mainland areas, the significant cost saving from solar could be especially attractive and prompt adoption of solar. Dr. Tierney also ignores the other incentives for households to switch to solar, such as the poor service and reliability of PREPA, and the desire to generate clean energy rather than depend on fossil fuels for energy.

49. **Dr. Tierney overstates load.** Dr. Tierney, in following Prof. Edwards' growth path, overstates the base load forecast. As discussed, Prof. Edwards' model produces an unrealistic outlook for growth on the Island under current policies. To bolster her position, Dr. Tierney makes comparisons to forecasts for base load demand in previous fiscal plans—plans that generally fell short of projections as presented in Figure 12 of her report. But 2017-2020 was a difficult period for forecasting due to the impact of Hurricanes Irma and María, and COVID. Notably, the FY 2021 forecast actually overestimated demand in 2022, also as shown in Figure 12.

50. **Alternative load demand.** Dr. Tierney argues for calculating load using the alternative load-demand scenario in the PREPA fiscal plan. This would be inconsistent with current law. The PREPA plan of adjustment ought to be consistent with the current legal framework and not anticipate falling short of standards required by law.

* * *

I reserve the right to supplement my opinions. I declare under penalty of perjury under 28 U.S.C. § 1746 that the foregoing is true and correct.

/s/ Andrew Wolfe
Andrew Wolfe
May 15, 2023

Exhibit A

CURRICULUM VITAE

Andrew M. Wolfe
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Windham, Maine, 04062

NATIONAL OF: United States

CURRENT POSITION: Fiscal Consultant for the Inter-American Development Bank

EDUCATION:

1978	B.S.E., Economics, University of Pennsylvania
1978	B.A.S., Engineering, University of Pennsylvania
1985	Ph.D., Economics, University of Wisconsin

LANGUAGES:

English-Native
Spanish-Fluent

CONSULTING EXPERIENCE

2022-present	Macroeconomic Consultant for the IADB in Honduras.
2016-2022	Macroeconomist for the Puerto Rico Financial Control Board.
2021-2022	Head of USAID project to design a manual for State Department staff involved in civil service reform
2021	Analysis of the Fiscal Consequences of Public Expenditure Reforms in Costa Rica (IADB project)
2018	Fiscal Savings from Civil Service Reform in Cost Rica (IADB project)
2017	Sovereign debt analysis for the Government of Guatemala (IADB project)
2016	Debt Sustainability Analysis for the Government of Nicaragua (IADB project)
2016	Presentation of IMF programming process for the Government of Honduras (IADB project)

UNIVERSITY EXPERIENCE:

2017 - 2022	Rice University, Adjunct Faculty in the James Baker School of Public Policy
2013 - 2021	American University, Adjunct Faculty in the School of International Studies
1983 - 1986	Bowdoin College, Assistant Professor

IMF CAREER:

1987-1992	Economist, Western Hemisphere Department (WHD)
1992-1995	Resident Representative, Uruguay (1992-95) and Argentina (1994-95)
1995-1997	Senior Economist, Fiscal Affairs Department
1997-2000	Resident Representative, Peru
2001-2002	IMF Mission Chief, Peru
2002-2005	IMF Mission Chief, Uruguay
2005-2006	Senior Resident Representative, Argentina
2006-2009	IMF Mission Chief, Dominican Republic
2009-2011	IMF Mission Chief, El Salvador and Colombia
2011-2014	Senior Personnel and Budget Manager, WHD, Head of IMF Human Resource Strategy Unit

PUBLICATIONS:

"Fiscal Accounting of Bank Restructuring". With James Daniel and Jeffrey Davis. IMF Paper on Policy Analysis and Assessment (PPAA/97/5), 1997.

"Las Orígenes, las Políticas, la Recuperación, y las Lecciones Aprendidas". Uruguay: Qué Aprendimos de la Crisis Financiera de 2002?. World Bank (May 29, 2007).

"A Primer on Currency Unification and Exchange Rate Policy in Cuba: Lessons from Exchange Rate Unification in Transition Economies". Co-author with Gabriel DiBella (IMF), Presented at the 2009 American Economics Association Meetings.

"Recession and Policy Transmission to International Tourism: Does Expanded Travel to Cuba offset Crisis Spillovers? Co-author with Rafael Romeu (IMF), ASCE 2010.

"Cuba: An approximation of the Output Gap". Co-author with Gabriel DiBella and Rafael Romeu (IMF), Presented at the 2011 American Economics Association Meetings.

"Puerto Rico—A Way Forward". With Anne O. Krueger and Ranjit Teja. Report written for the Government Development Bank of Puerto Rico, June 2015.

"Puerto Rico—Diagnosis of the Problem". With Anne O. Kruger. Chapter in upcoming book on the economic crisis in Puerto Rico (manuscript in draft).

Exhibit B

Previous Expert Testimony

Peaje Investments LLC, v. Puerto Rico Highways and Transportation Authority, U.S. District Court for the District of Puerto Rico (Adv. Proc. No. 17-151-LTS in 17 BK 3567-LTS; Adv. Proc. No. 17-152-LTS in 17 BK 3283-LTS)

- Deposition, July 2017
- Hearing, August 2017

In re: The Financial Oversight and Management Board for Puerto Rico, as representative of The Commonwealth of Puerto Rico, et al., U.S. District Court for the District of Puerto Rico (17 BK 3283-LTS) and *In re The Financial Oversight and Management Board for Puerto Rico, as representative of Puerto Rico Electric Power Authority*, U.S. District Court for the District of Puerto Rico (17 BK 4780-LTS)

- Stipulated hearing testimony, February 2018

Union de Trabajadores de la Industria Electrica y Riego, Inc. (UTIER) v. The Financial Oversight and Management Board for Puerto Rico as Representative of Puerto Rico Electric Power Authority (PREPA), U.S. District Court for the District of Puerto Rico (Adv. Proc. No. 17-0229-LTS in 17 BK 4780-LTS)

Exhibit C

ARTICLES and REPORTS

Acemoglu, D., “The Solow Growth Model”, Introduction to Modern Economic Growth. (Princeton University Press: Princeton, 2009).

Baily, M.N., Bosworth, B. and Doshi, S. “Productivity comparisons: Lessons from Japan, the United States, and Germany,” Brookings Institution, January 2020.

Brown, J.P. “Identifying State-Level Recessions,” Federal Reserve Bank of Kansas City, February 22, 2017, available at <https://www.kansascityfed.org/search/?query=Jason%20Brown&sorting=relevant&page-number=1&perpage=10>.

Buschsbaum, J. “Long-run price elasticities and mechanisms: Empirical evidence from residential electricity consumers” University of California at Berkeley, Unpublished Job Market Paper, February 9, 2022.

Chisari, O., Estache, A., and Romero, C. “Winners and Losers from the Privatization and Regulation of Utilities: Lessons from a General Equilibrium Model of Argentina,” The World Bank Economic Review, Vol. 13, No. 2, pp.357-78.

Diaz-Bautista, A. and González-Andrade S.. “The Debate of the Modern Theories of Regional Economic Growth,” Journal Rai Ximhai, Vol. 10, No. 6, July-December 2014, pp. 187-206.

Edelberg, W. and Werling, J. “How CBO Develops the Economic Projections Underlying Its Long-Term Budget Projections,” Congressional Budget Office, February 15, 2019.

Estudios Técnicos Inc., “Estudio sobre la Economía Informal en Puerto Rico,” August 3, 2010.

Expert Report of Dr. Glenn R. George and support files.

Expert Report of Dr. Maureen Chakraborty and support files.

Expert Report of Dr. Ramón Cao.

Expert Report of Professor Sebastian Edwards and support files.

Expert Report of Dr. Susan Tierney and support files.

Expert Report of Mr. Gary Struymeyer and support files.

Fiscal Plan of the Commonwealth June 2022.

Fiscal Plan of the Commonwealth March/April 2017.

Fiscal Plan of the Commonwealth April 2023, Vol.1.

Fiscal Plan of the Commonwealth April 2023, Vol.2.

Fiscal Plan of the Commonwealth April 2023, Vol.3.

Fiscal Plan of PREPA, April 2017.

Fiscal Plan of PREPA, May 2021.

Fiscal Plan of PREPA, June 2022.

IMF Investment And Capital Stock Dataset (ICSD) 2021: Manual & FAQ - Estimating Public, Private, and PPP Capital Stocks.

Jeffers, R.F., et.al. "Analysis of Microgrid Locations Benefitting Community Resilience for Puerto Rico," Sandia National Laboratories, SAND2018-11145, September 30, 2018.

Keating, J. W. "Structural Approaches to Vector Autoregressions", Federal Reserve Bank of St. Louis, Sep/Oct 1992, pp.37-57.

Krueger, A.O., Teja, R. and Wolfe, A. "Puerto Rico: A Way Forward," (Krueger Report) June 29, 2015 and July 13, 2015 update, available at, respectively, <http://www.gdb-pur.com/documents/PuertoRicoAWayForward.pdf> and <http://www.gdb-pur.com/documents/PuertoRicoReport-Update.pdf>.

Mose, N.G. "Determinants of regional economic growth in Kenya," African Journal of Business Management, Vol. 15 No. 1 , January 2021, pp. 1-12.

Robertson, J. and Tallman, E. "Vector Autoregressions: Forecasting and Reality", Federal Reserve Bank of Atlanta, Economic Review, Q1, 1999.

Shackleton, R. "Estimating and Projecting Potential Output Using CBO's Forecasting Growth Model," Congressional Budget Office, WP 2018-03, February 2018.

Sims, Christopher A. "A Nine-Variable Probabilistic Macroeconomic Forecasting Model." In Business Cycles, Indicators, and Forecasting, edited by James H. Stock and Mark W. Watson. Chicago: University of Chicago Press 1992.

Sims, Christopher A., and Tao A. Zha. "Bayesian Methods for Dynamic Multivariate Models", International Economic Review 39, no. 4:949-68, 1998.

Solow, R.M. "A Contribution to the Theory of Economic Growth," Quarterly Journal of Economics, Vol. 70, No. 1, February 1956, pp. 65-94.

Tatum III, J.L. “Detroit’s Bankruptcy and Market Reentry”, Emory Bankruptcy Developments Journal, Vol. 37, Issue 1, 2020.

DATA SOURCES

April 2023 Fiscal Plan Model vShare (Dataroom).xlsx.

<https://data.worldbank.org/indicator/ST.INT.RCPT.CD>

<https://data.census.gov/cedsci/table?d=ACS%205-Year%20Estimates%20Data%20Profiles&table=DP05&tid=ACSDP5Y2017.DP05&g=0400000US72&vintage=2017&hidePreview=true>

<https://databank.worldbank.org/source/world-development-indicators#>

<https://fred.stlouisfed.org/categories/27332>.

IMF World Economic Outlook (various years).
<https://www.imf.org/en/Publications/WEO/Issues/YEAR/>.

January 2022 Fiscal Plan Model Certified (Dataroom).xlsx.

PREPA 2022 Fiscal Plan Model.xlsx.

P_Data_Extract_From_World_Development_Indicators.xlsx.

LEGAL FILINGS

Disclosure Statement for Modified Second Amended Title III Plan of Adjustment of the Puerto Rico Electric Power Authority, 003297.00 [2023-03-01].

Modified Second Amended Title III Plan of Adjustment of the Puerto Rico Electric Power Authority, 003297.00 [2023-03-01].

Motion Of The Ad Hoc Group Of PREPA Bondholders, Assured Guaranty Corp., Assured Guaranty Municipal Corp., National Public Finance Guarantee Corporation, And SYNCORA Guarantee, Inc. To Dismiss PREPA’S Title iii Case, Or For Relief From The Automatic Stay To Enforce Their Right To A Receiver, Case:17-04780-LTS Doc#:2973 Filed:09/19/22.

Objection Of SYNCORA Guarantee, Inc. To The Motion Of Puerto Rico Electric Power Authority For An Order (i) Approving Disclosure Statement, (ii) Fixing Voting Record Date, (iii) Approving Confirmation Hearing Notice And Confirmation Schedule, (iv) Approving Solicitation Packages And Distribution Procedures, (v) Approving Forms Of Ballots And Voting Procedures, (vi) Approving Notice Of Non-Voting Status, (vii) Fixing Voting And Confirmation Deadlines, and (viii) Approving Vote Tabulation Procedures Case:17-03283-LTS Doc#:23480 Filed:02/03/23.

Omnibus Objections Of The Ad Hoc Group Of PREPA Bondholders To The Disclosure Statement For The Title III Plan Of Adjustment Of The PUERTO RICO ELECTRIC POWER AUTHORITY [ECF NO. 3111], and Related Procedural Motions Related To The Disclosure Statement And Plan Confirmation [ECF NOS. 3113, 3114], Case:17-03283-LTS Doc#:23481 Filed:02/03/23.

Urgent Motion Of The Ad Hoc Group Of PREPA Bondholders Pursuant To Section 312 Of PROMESA And Section 105 Of The Bankruptcy Code To Compel Mediation And Impose Deadlines For A PREPA Plan Of Adjustment, Case:17-04780-LTS Doc#:2716 Filed:02/18/22.